Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(4): 1676-1681
Received: 26-05-2018
Accepted: 28-06-2018

PS Patil
Department of Soil Science and Agriculture Chemistry, College of Agriculture, Parbhani, Maharashtra, India

VM Dalavi
Research Scholar, SHUATS, Allahabad, Utter Pradesh, India

HK Kausadikar
Associate Professor, VNMKV, Parbhani, Maharashtra, India

Correspondence
PS Patil
Department of Soil Science and Agriculture Chemistry, College of Agriculture, Parbhani, Maharashtra, India

Evaluate sweet orange orchard soils of Jalna district for nutritional status

PS Patil, VM Dalavi and HK Kausadikar

Abstract
An investigation was carried out to study the evaluation of nutrient status of sweet orange orchards in Jalna district by soil analysis. One hundred representative sweet orange orchards from of sweet orange growing belt of Jalna district having cultivation of more than one ha with different health status were selected for the study. From 100 sweet orange orchards, soil samples of 0-30 cm depth were collected by considering depth and texture of soil.

On the basis of soil Physico-chemical properties, sweet orange orchard soils were found to be neutral to alkaline in soil reaction, (pH: 7.3-8.3) with normal range of salinity (EC: 0.09-0.39 dSm^{-1}) along with non-calcareous to moderately calcareous nature ($CaCO_3$: 2.2-5.9 %) and moderately high to very high organic carbon content (OC : 0.71-1.49 %). Regarding fertility status, sweet orange orchard soils are very low in available N (128.3-241.2 kg ha^{-1}), low to medium in available P (7.34-19.37 kg ha^{-1}) and medium to rich in available K (223.3-1042.6 kg ha^{-1}). Further, it was observed that these are soils were well supplied with available Ca and Mg nutrient (1265-4320 and 356-1232 mg kg^{-1}). Among micro nutrients, sweet orange orchard soils are 44 % deficient in DTPA Fe (2.73-9.8 mg kg^{-1}) and 51 % deficient in are DTPA Zn (0.42-1.76 mg kg^{-1}) and are 100 % sufficient in Cu (0.89-4.05 mg kg^{-1}) and Mn (4.75-26.75 mg kg^{-1}). Soil analysis of sweet orange orchards in Jalna district confirmed the wide spread deficiencies of soil nutrients *viz.*, N, Zn and Fe.

Keywords: Physico-chemical properties, Jalna District, Micro nutrients, Sweet orange orchards

Introduction
Citrus is the third largest fruit crop grown in India after Mango and Banana. Commercially, Sweet orange, Mandarin and Acid lime are grown in different agro-climatic regions. Citrus is grown on a wide range of soils and under varied climates in the belt between 35^0 north and 54^0 south latitudes. In the tropics, citrus production is mostly on small scale for local consumption and commercial production is concentrated in the subtropical areas. It is considered to be a native of south eastern Asia. Citrus is the most highly priced of all tropical and subtropical fruits. Sweet orange are excellent source of Vit-C and also supply other vitamins, minerals and alkaline salts which are needed in diet as a health promoting substances.

Area and production of citrus in India in the past three decades have increased annually @ 10.5 percent and 7.8 percent, respectively (Srivastava and Singh, 2003) [15]. India accounts for 4.69 percent of total citrus production (4.43 million tons) in world occupying 0.37 million ha (Singh and Sharma, 2000) [13]. In Maharashtra, area under sweet orange cultivation is 107.00 thousand ha with production of 652.00 thousand MT and productivity 6.1 MT/ha. Commercially, sweet orange is grown in Jalna, Aurangabad and Nanded districts of Marathwada region of Maharashtra State. Though sweet orange is grown on diverse type of soil, its successful cultivation entirely depends upon physical, chemical, biological and mineralogical characteristic of soils. Various soil properties were identified as the limiting factors in sweet orange cultivation. Zinc deficiency often occurs due to heavy phosphate application. Manganese deficiency occurs especially due to over liming and heavy phosphate application in the soil. Copper deficiency is induced by heavy liming and excessive application of nitrogen and phosphate.

One of the main reasons for low sweet orange orchard productivity in the soils of Marathwada region is multiple nutrients deficiencies. The soils of this region are mostly derived from basaltic parent material and are commonly deficient in multiple nutrients including N, P, Fe, Mn, and Zn. (Srivastava and Singh, 2004) [14]. There are reports from different parts of the country on the occurrence of deficiencies of micronutrients *viz.*, Fe, Zn, Mn, B, and Cu in citrus orchards. The sweet orange orchards in Vidarbha and Marathwada regions and facing the problem of decline on large scale. It is observed that Sweet orange makes better growth in initial years but start declining after a few years of heavy fruiting. The citrus decline may be due to one or other nutritional disorders. Though the nutrient requirements of major elements

is met by supplementing NPK fertilizer but farmers usually forgot about micronutrients, which are the most essential part of citrus nutrition. Deficient micronutrients not only reduce the productivity of crops but also reduce the use efficiency of applied major nutrients.

Material and Methods

To evaluate nutrient status and severity of nutrient deficiencies in Sweet orange orchards, survey of Sweet orange orchards Jalna district was carried out during month of May - 2014. The Marathwada region of Maharashtra State lies between $17^0 35'$ to $20^0 40'$ north latitude and $74^0 40'$ to $78^0 15'$ east longitude. Citrus growing area of the region however, lies between 19^0 to 20^0 north latitude and $75^0 20'$ to $77^0 30'$ east longitude. The citrus belt is spread in the four districts *viz.*, Nanded, Parbhani, Jalna and Aurangabad.

Soil Sampling

Majority of soils of Jalna district falls in the category of medium black to deep black. The black soils under study area are formed from the weathering of trap rock, rich in iron, copper and magnesium. The district is covered by Deccan trap and development is therefore influenced by the tropical situation. In general, the soils of the district do not show much variation in physical, chemical properties and high exchangeable capacity of the soils which indicates the inherent high soil fertility status.

Selection of sweet orange orchards

Hundred representative Sweet orange orchards of growing belt of Jalna district having cultivation of more than one hectare with different plant health status were randomly selected for the present investigation. The map of Jalna district showing Sweet orange orchard growing belt and selected locations. The information about the location of orchards, name of cultivator, area of orchards.

Method of collection of soil sample

Surface soil samples (0-30 cm) were collected avoiding any metallic contamination with the help of wooden Khurpi and scoop. Soil samples from 0-30 cm depth were collected from 100 Sweet orange orchards of Jalna district. The sample was collected from peripheral area of each tree per orchard depending upon area. The samples were placed in clean cloth bags, labeled properly and brought to laboratory. The soil samples after drying in shade were ground by wooden mortar and pestle and passed through 2 mm sieves and kept in clean polythene bags with proper labeling. Similarly, leaf samples from the same orchards were also collected.

Result and Discussion

Evaluate Sweet Orange Orchard Soils of Jalna District for Nutritional Status

The data presented in table 01 revealed that, in case of Jafrabad tehsil pH, EC, OC and $CaCO_3$ was of varied range from 7.79 to 7.79, 0.24 to 0.24 dSm^{-1}, 0.84 to 0.84 per cent, and 3.4 to 3.4 percent with mean 7.79, 0.24 dSm^{-1}, 0.84 percent and 3.4 percent, respectively. In case of Bhokardan tehsil pH, EC, OC and $CaCO_3$ was of varied range from 7.94 to 7.94, 0.28 to 0.28 dSm^{-1}, 1.22 to 1.22 percent and 3.7 to 3.7 with mean 7.94, 0.28 dSm^{-1}, 1.22 percent and 3.7 percent, respectively. The similar type of observation was recorded by Sharma (1990) [12] in nutrient status of Mandarin orchards in Himachal Pradesh.

The data present in table 01 revealed that, in case of Badnapur tehsil pH, EC, OC and $CaCO_3$ was of varied range from 7.82 to 7.98, 0.21 to 0.28 dSm^{-1}, 0.76 to 0.98 percent and 3.4 to 3.9 percent with mean 7.91, 0.23 dSm-1, 0.89 percent and 3.6 percent. respectively. In case of Ambad tehsil pH, EC, OC and $CaCO_3$ was of varied range from 7.86 to 7.86, 0.24 to 0.24 dSm^{-1}, 0.90 to 0.90 percent and 3.7 to 3.7 percent with mean 7.86, 0.24 dSm^{-1}, 0.90 percent and 3.7 percent, respectively. The similar type of observation recorded by Malewar (1978) [7] and Patil (1997) [10] in sweet orange orchards of Marathwada region.

Thus, the data presented in table 01 revealed that, the pH, EC, OC and $CaCO_3$ was of varied range from 7.50 to 8.36, 0.19 to 0.28 dSm^{-1}, 0.78 to 1.22 percent, 3.2 to 4.0 percent with mean 7.85, 0.23 dSm^{-1}, 0.91 percent and 3.6 per cent. Malewar *et al*., (1978) [7] and Patil (1997) [10] reported that soil of Marathwada region under sweet orange orchards.

Soil micronutrient status of sweet orange orchards.

The village wise micronutrient properties of the sweet orange orchards soil from Jalna district are presented in table 02.

The data presented in table 02 revealed that, DTPA - Fe was varied from 3.93 to 5.36 mg kg^{-1} and with average value of 4.77mg kg^{-1}, in sweet orange orchard soil of Jalna district. The tehsil wise description of the soil DTPA - Fe parameter revealed that among eight tehsils of Jalna district, Partur tehsil is having content Fe average 3.93 mg kg^{-1} whereas, Jafrabad tehsil is having Fe average 5.36 mg kg^{-1} sweet orange orchards out of 100 orchards 44 per cent orchards are deficient in DTPA – Fe. The similar type of observation was recorded by Malewar *et al*., (1978) [7] and Patil (1997) [10] reported that soil of Marathwada region under sweet orange orchards.

The data presented in table 02 revealed that, Mn varied from 10.68 to 16.45 mg kg^{-1} with average value of 13.36 mg kg^{-1} in Jalna district. The tehsil wise description of the soil DTPA - Mn revealed that Jafrabad tehsil is having content Mn average 10.68 mg kg^{-1}, whereas, Mantha Tehsil is having Mn average 16.45mg kg^{-1}. All orchards soil are sufficient in DTPA – Mn. The similar type of observation was recorded by Dhale and Prasad (2009) in sweet orange orchards of Marathwada region.

The data presented in table 02 revealed that, Zn was varied from 0.85 to 1.36 mg kg^{-1} with average value of 1.09 mg kg^{-1} in Jalna district. The tehsil wise description of the soil DTPA-Zn revealed that Partur tehsil is having content Zn average 0.85 mg kg^{-1},whereas, Bhokardan tehsil is having Zn average 1.36 mg kg^{-1}. Thus, 51 per cent sweet orange orchards soils of Jalna district are deficient in DTPA – Zn, respectively. similar of type The observation was recorded by Patiram *et al.*, (2000) in sweet orange orchards of Sikkim.

The data presented in table 02 revealed that, Cu was varied from 2.07 to 2.94 mg kg^{-1} with average value of 2.49 mg kg^{-1} in Jalna district. The tehsil wise description of the DTPA - Cu parameter revealed that Jalna tehsil is having content Cu average 2.07 mg kg^{-1}, whereas, Partur tehsil is having Cu average 2.94 mg kg^{-1}, respectively. The similar type of observation was recorded by Patiram *et al.*, (2000) in sweet orange orchards of Sikkim.

Among micro nutrients, soils were deficient in DTPA Fe and Zn contents and were sufficient in DTPA Cu and Mn. Results are in agreement with the findings of Patiram *et al.* (2000) in sweet orange orchards of Sikkim. The macronutrient and micronutrient properties of the soils of sweet orange orchards tehsil wise from Jalna district are presented in table 03.

The data presented in table 03 revealed that, Mantha tehsil among primary soil nutrient, available N, P and K varied from 152.6 to 208.3 kg ha^{-1}, 9.49 to 15.63 kg ha^{-1} and 3046 to 1042.6 kg ha^{-1} and with average value of 181.4 kg ha^{-1}, 11.31 kg ha^{-1} and 594.3 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1906 to 4320 mg kg^{-1} and 356 to 704 mg kg^{-1} with a mean value 2662.5 mg kg^{-1} and 453.2 mg kg^{-1}, respectively cationic micronutrients *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.84 to 1.76 mg kg^{-1}, 1.9 to 3 mg kg^{-1}, 4.66 to 6.21 mg kg^{-1} and 10.87 to 26.75 mg kg^{-1} with average value of 1.15 mg kg^{-1}, 2.32 mg kg^{-1}, 5.36 mg kg^{-1} and 16.45 mg kg^{-1} respectively in soil. The similar type of observation was recorded by Malewar *et al*., (1978) [7] and Patil (1997) [10] in soil of Marathwada region under sweet orange orchards.

The data presented in table 03 revealed that, Mantha tehsil among primary soil nutrient, available N, P and K varied from 152.6 to 208.3 kg ha^{-1}, 9.49 to 15.63 kg ha^{-1} and 3046 to 1042.6 kg ha^{-1} and with average value of 181.4 kg ha^{-1}, 11.31 kg ha^{-1} and 594.3 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1906 to 4320 mg kg^{-1} and 356 to 704 mg kg^{-1} with a mean value 2662.5 mg kg^{-1} and 453.2 mg kg^{-1}, respectively cationic micronutrients *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.84 to 1.76 mg kg^{-1}, 1.9 to 3 mg kg^{-1}, 4.66 to 6.21 mg kg^{-1} and 10.87 to 26.75 mg kg^{-1} with average value of 1.15 mg kg^{-1}, 2.32 mg kg^{-1}, 5.36 mg kg^{-1} and 16.45 mg kg^{-1} respectively in soil. The similar type of observation was recorded by Malewar *et al*., (1978) [7] and Patil (1997) [10] in soil of Marathwada region under sweet orange orchards.

The data presented in table 03 revealed that, Partur tehsil among primary soil nutrient, available N, P and K varied from 171.24 to 171.24 kg ha^{-1}, 10.7 to 10.7 kg ha^{-1} and 425.85 to 425.85 kg ha^{-1} with average value of an 171.24 kg ha^{-1}, 10.7 kg ha^{-1} and 425.85 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 2993 to 2993 mg kg^{-1} and 953 to 953 mg kg^{-1} with mean value 2993 mg kg^{-1} and 953 mg kg^{-1}, respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.85 to 0.85 mg kg^{-1}, 2.94 to 2.94 mg kg^{-1}, 3.93 to 3.93 mg kg^{-1} and 15.05 to 15.05 mg kg^{-1} with average value of 0.85 mg kg^{-1}, 2.94 mg kg^{-1}, 3.93 mg kg^{-1} and 3.93 mg kg^{-1} respectively in soil. The similar type of observation was recorded by Malewar *et al*., (1978) [7] in sweet orange orchards of Marathwada region.

The data presented in table 03 revealed that, Jalna tehsil among primary soil nutrient, available N, P and K varied from 205.35 to 241.2 kg ha^{-1}, 10.87 to 14.49 kg ha^{-1} and 412.4 to 867.2 kg ha^{-1} with average value of 181.4 kg ha^{-1}, 11.31 kg ha^{-1} and 594.3 kg ha^{-1}, respectively secondary nutrients soil exchangeable Ca and Mg ranged from 1986 to 2492.3 mg kg^{-1} and 540.7 to 1188 mg kg^{-1} with mean value 2286.5 mg kg^{-1} and 928.2 mg kg^{-1}, respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.9 to 1.55 mg kg^{-1}, 1.24 to 2.87 mg kg^{-1}, 4.28 to 4.98 mg kg^{-1} and 11.37 to 15.16 mg kg^{-1} with average value of 1.20 mg kg^{-1}, 2.04 mg kg^{-1}, 4.51 mg kg^{-1} and 13.30 mg kg^{-1}, respectively in soil. The similar type of observation was recorded by Patil (1997) [10] in soil of Marathwada region under sweet orange orchards.

The data presented in table 03 revealed that, Ghansawangi tehsil among primary soil nutrient, available N, P and K varied from 162.35 to 205.2 kg ha^{-1}, 8.86 to 12.66 kg ha^{-1} and 405.5 to 497.2 kg ha^{-1} with average value of an 186.70 kg ha^{-1}, 11.16 kg ha^{-1} and 463.0 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1715.8 to 2113 mg kg^{-1} and 723 to 1110 mg kg^{-1}, with a mean values 1970.2 mg kg^{-1} and 928.0 mg kg^{-1}, respectively cationic micronutrients *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.8 to 1.31 mg kg^{-1}, 2.46 to 3.14 mg kg^{-1}, 4.27 to 4.54 mg kg^{-1} and 12.07 to 14.43 mg kg^{-1} with average value of 1.09 mg kg^{-1}, 2.75 mg kg^{-1}, 4.40 mg kg^{-1} and 13.05 mg kg^{-1}, respectively in soil type of observation was recorded by Gorde (1994) in sweet orange in Marathwada region.

The data presented in table 03 revealed that, Jafrabad tehsil among primary soil nutrient, available N, P and K varied from 215.59 to 215.59 kg ha^{-1}, 11.32 to 11.32 kg ha^{-1} and 437.8 to 437.8 kg ha^{-1} with average value of an 215.59 kg ha^{-1}, 11.32 kg ha^{-1} and 437.8 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1726 to 1726 mg $kg^{-1}$and 733.8 to 733.8 mg kg^{-1}, with a mean values 1726 mg kg^{-1} and 733.8 mg kg^{-1}, respectively cationic micronutrients *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.97 to 0.97 mg kg^{-1}, 2.72 to 2.72 mg kg^{-1}, 5.36 to 5.36 mg kg^{-1} and 10.68 to 10.68 mg kg^{-1} with average value of 0.97 mg kg^{-1}, 2.72 mg kg^{-1}, 5.36 mg kg^{-1} and 10.68 mg kg^{-1}, respectively in soil. Similar observations recorded by Kausadikar (2005) in sweet orange orchards of Marathwada region.

The data presented in table 03 revealed that, Bhokardan tehsil among primary soil nutrient, available N, P and K varied from 197.06 to 197.06 kg ha^{-1}, 12.01 to 12.01 kg ha^{-1} and 454.0 to 454.0 kg ha^{-1} with average value of an 197.06 kg ha^{-1}, 12.01 kg ha^{-1} and 454.0 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged value from 1984.3 to 1984.3 mg kg^{-1} and 776.0 to 776.0 mg kg^{-1} with mean value 1984.3 mg kg^{-1} and 776.0 mg kg^{-1}, respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged between 1.36 to1.36 mg kg^{-1}, 2.33 to 2.33 mg kg^{-1}, 5.28 to 5.28 mg kg^{-1} and 11.34 to 11.34 mg kg^{-1} with average value of 1.36 mg kg^{-1}, 2.33 mg kg^{-1}, 5.28 mg kg^{-1} and 11.34 mg kg^{-1}, respectively in soil. The similar type of observation was recorded by Dhale and Prasad (2009) [1] in sweet orange orchards of Marathwada region.

The data presented in table 03 revealed that, Badnapur tehsil among primary soil nutrient, available N, P and K varied from 186.05 to 214.85 kg ha^{-1}, 11.81 to 13.6 kg ha^{-1} and 374.6 to 597.1 kg ha^{-1} with average value of an 204.32 kg ha^{-1}, 12.42 kg ha^{-1} and 491.5 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1911.3 to 2617 mg kg^{-1} and 576.8 to 992.1 mg kg^{-1} with a mean values 2207.0 mg kg^{-1} and 725.6 mg kg^{-1}, respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.76 to 1.29 mg kg^{-1}, 2.16 to 2.98 mg kg^{-1}, 4.35 to 6.5 mg kg^{-1} and 9.11 to 14.86 mg kg^{-1} with average value of 1.00 mg kg^{-1}, 2.42 mg kg^{-1}, 5.00 mg kg^{-1} and 12.48 mg kg^{-1}, respectively in soil. Similar observations recorded by Jadhav (2007) [4] in sweet orange orchards of Marathwada region.

The data presented in table 03 revealed that, Ambad tehsil among primary soil nutrient, available N, P and K varied from 197.11 to197.11 kg ha^{-1}, 12.58 to 12.58 kg ha^{-1} and 438.1 to 438.1 kg ha^{-1} with average value of an 197.11 kg ha^{-1}, 12.58 kg ha^{-1} and 438.1 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 1941.1 to 1941.1 mg kg^{-1} and 825.0 to 825.0 mg kg^{-1} with a mean value 1941.1 mg kg^{-1} and 825.0 mg kg^{-1}, respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged between 1.11 to 1.11 mg kg^{-1}, 2.39 to 2.39 mg kg^{-1}, 4.33 to 4.33 mg kg^{-1} and 14.56 to 14.56 mg kg^{-1} with average value of 1.11 mg kg^{-1}, 2.39 mg kg^{-1}, 4.33 mg kg^{-1} and 14.56 mg kg^{-1}, respectively in soil. The similar type of observation was recorded by Kausadikar (2003) [6] in sweet orange orchards of

Maharashtra. The data presented in table 03 revealed that, Jalna district among primary soil nutrient, available N, P and K varied from 171.24 to 216.17 kg ha^{-1}, 10.7 to 12.73 kg ha^{-1} and 425 to 594.3 kg ha^{-1} with average value of an 196.2 kg ha^{-1}, 11.77 kg ha^{-1} and 487.0 kg ha^{-1}, respectively secondary nutrients like soil exchangeable Ca and Mg ranged from 2993 to 1726 mg kg^{-1} and 453.2 to 953 mg kg^{-1} with a mean values 2221.3 mg kg^{-1} and 793.7 mg kg^{-1} respectively cationic micronutrient *viz.*, Zn, Cu, Fe and Mn were ranged from between 0.85 to 1.36 mg kg^{-1}, 2.07 to 2.94 mg kg^{-1}, 3.93 to 5.36 mg kg^{-1} and 10.68 to 16.45 mg kg^{-1} with average value of 1.09 mg kg^{-1}, 2.49 mg kg^{-1}, 4.77 mg kg^{-1} and 13.36 mg kg^{-1}, respectively in soil. Higher content of Ca and Mg in soil could be justified because of basaltic parent material from which these soils are derived which is also rich in alkali earth like lime and magnesia (Malewar *et al.*, 1978) [7] in sweet orange orchards of Marathwada region.

Table 1: Tehsil wise physico-chemical characteristics of sweet orange orchards soils from Jalna district.

Tehsil		pH	EC (dSm^{-1})	OC (%)	$CaCO_3$ (%)
Mantha	Range	7.36-7.55	0.14-0.31	0.74-0.83	2.5-4.9
	Mean	7.50	0.23	0.78	3.9
Partur	Range	7.62-7.62	0.19-0.19	0.90-0.90	3.2-3.2
	Mean	7.62	0.19	0.90	3.2
Jalna	Range	7.83-8.36	0.21-0.30	0.80-1.08	3.4-4.0
	Mean	8.02	0.24	0.93	3.7
Ghansawangi	Range	7.65-8.2	0.20-0.22	0.78-0.98	3.8-4.5
	Mean	7.83	0.21	0.86	4.0
Jafrabad	Range	7.79-7.79	0.24-0.24	0.84-0.84	3.4-3.4
	Mean	7.79	0.24	0.84	3.4
Bhokardan	Range	7.94-7.94	0.28-0.28	1.22-1.22	3.7-3.7
	Mean	7.94	0.28	1.22	3.7
Badnapur	Range	7.82-7.98	0.21-0.28	0.76-0.98	3.4-3.9
	Mean	7.91	0.23	0.89	3.6
Ambad	Range	7.86-7.86	0.24-0.24	0.90-0.90	3.7-3.7
	Mean	7.86	0.24	0.90	3.7
Jalna	Range	7.50-8.36	0.19-0.28	0.78-1.22	3.2-4.0
	Mean	7.85	0.23	0.91	3.6

Table 2: Village wise soils macronutrient and micronutrient status of sweet orange orchards in Jalna district. (Mean values)

Village / Taluka	N	P	K	Ca	Mg	Zn	Cu	Fe	Mn
Unit	kg ha^{-1}			mg kg^{-1}					
Gevrai	208.31	15.63	897.55	2212.5	704	0.92	1.9	6.21	10.87
Aakai	195.88	9.49	1042.6	2240	397	1.25	2.5	5.06	20.17
Kandali	177.52	10.07	357.1	1906	394	0.98	1.9	4.66	13.25
Aakani	152.68	11.71	304.6	4320	356	0.84	2.1	4.98	26.75
Vaturphata	170.85	9.67	369.6	2634	415	1.76	3.0	5.88	11.25
Mantha	181.40	11.31	594.3	2662.5	453.2	1.15	2.32	5.36	16.45
Yeldapur	171.24	10.7	425.85	2993	953	0.85	2.94	3.93	15.05
Partur	171.24	10.7	425.85	2993	953	0.85	2.94	3.93	15.05
Ramnagar	209.27	14.49	412.4	2418.7	540.7	1.33	2.87	4.35	14.96
Savrgao	211.04	13.44	487.8	2249.2	885.8	0.90	2.12	4.43	11.37
Dhanurshivar	241.20	10.87	867.2	1986	1188	1.55	1.24	4.98	15.16
Viregao	205.35	12.12	599.1	2492.3	1098.3	1.05	1.96	4.28	11.74
Jalna	216.71	12.73	591.6	2286.5	928.2	1.20	2.07	4.51	13.30
Rajni	162.35	8.86	497.2	2082	1110	1.31	2.67	4.27	12.70
Krushnapurwadi	205.21	11.96	405.5	1715.8	951.2	1.10	3.14	4.44	14.43
Hivra	193.15	12.66	486.4	2113	723.0	0.80	2.46	4.54	12.04
Ghansavangi	186.70	11.16	463.0	1970.2	928.0	1.09	2.75	4.40	13.05
Asai	215.59	11.32	437.8	1726	733.8	0.97	2.72	5.36	10.68
Jafrabad	215.59	11.32	437.8	1726	733.8	0.97	2.72	5.36	10.68
Kedarkhada	197.06	12.01	454.0	1984.3	776.0	1.36	2.33	5.28	11.34
Bhokardan	197.06	12.01	454.0	1984.3	776.0	1.36	2.33	5.28	11.34
Varudi	186.05	12.12	597.1	2417.5	576.8	0.76	2.94	5.51	9.11
G.Bajar	210.25	13.60	374.6	2617	619.4	0.89	2.98	4.88	13.08
Kandari	214.85	12.00	451.8	2288.1	858.0	1.29	2.23	6.50	13.08
Sumthana	211.53	13.00	564.2	1912	691.8	0.82	2.39	4.35	10.24
Dudhanvadi	204.41	11.99	481.1	2096.7	777.7	1.15	2.16	4.40	13.73
Badnapur	198.84	11.81	480.5	1911.3	992.1	1.09	2.43	4.39	14.86
Badnapur	204.32	12.42	491.5	2207.0	752.6	1.00	2.42	5.00	12.48
Badapur	197.11	12.58	438.1	1941.1	825.0	1.11	2.39	4.33	14.56
Ambad	197.11	12.58	438.1	1941.1	825.0	1.11	2.39	4.33	14.56
Jalna (Range/Mean)	(171.24-216.17) 196.2	(10.7-12.73) 11.77	(425.8-594.3) 487.0	(1726-2993) 2221.3	(453.2-953) 793.7	(0.85-1.36) 1.09	(2.07-2.94) 2.49	(3.93-5.36) 4.77	(10.68-16.45) 13.36

Table 3: Tehsil wise soils macro and micronutrient status of sweet orange orchards in Jalna district.

Tehsil	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Ca (mg kg^{-1})	Mg (mg kg^{-1})	Zn (mg kg^{-1})	Cu (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})
Mantha	(152.6-208.3) 181.4	(9.49-15.63) 11.31	(304.6-1042.6) 594.3	(1906-4320) 2662.5	(356-704) 453.2	(0.84-1.76) 1.15	(1.9-3) 2.32	(4.66-6.21) 5.36	(10.87-26.75) 16.45
Partur	(171.2-171.2) 171.2	(10.7-10.7) 10.7	(425.8-425.8) 452.8	(2993-2993) 2993	(953-953) 953	(0.85-0.85) 0.85	(2.9-2.9) 2.9	(3.93-2.93) 2.93	(15.05-15.05) 15.05
Jalna	(205.35-241.2) 216.71	(10.87-14.49) 12.73	(412.4-867.2) 591.6	(1986-2492.3) 2286.5	(540.7-1188) 928.2	(0.9-1.55) 1.20	(1.24-2.87) 2.04	(4.28-4.98) 4.51	(11.37-15.16) 13.30
Ghansawangi	(162.35-205.2) 186.70	(8.86-12.66) 11.16	(405.5-497.2) 463.0	(1775.8-2113) 1970.2	(723-1110) 928.0	(0.8-1.3) 1.09	(2.46-3.14) 2.75	(4.27-4.54) 4.40	(12.07-14.43) 13.05
Jafrabad	(215.59-215.59) 215.59	(11.32-11.32) 11.32	(437.8-437.8) 437.8	(1726-1726) 1726	(733.8-733.8) 733.8	(0.97-0.97) 0.97	(2.72-2.72) 2.72	(5.36-5.36) 5.36	(10.68-10.68) 10.68
Bhokardan	(197.06-197.06) 197.06	(12.01-12.01) 12.01	(454.0-454.0) 454.0	(1984.3-1984.3) 1984.3	(776.0-776.0) 776.0	(1.36-1.36) 1.36	(2.33-2.33) 2.33	(5.28-5.28) 5.28	(11.34-11.34) 11.34
Badnapur	(186.05-214.85) 204.32	(11.81-13.6) 12.42	(374.6-597.1) 491.5	(1911.3-2617) 2207.0	(576.8-992.1) 725.6	(0.76-1.29) 1.00	(2.16-2.98) 2.42	(4.35-6.5) 5.00	(9.11-14.86) 12.48
Ambad	(197.11-19711) 197.11	(12.58-12.58) 12.58	(438.1-438.1) 438.1	(1941.1-1941.1) 1941.1	(825.0-825.0) 825.0	(1.11-1.11) 1.11	(2.39-2.39) 2.39	(4.33-4.33) 4.33	(14.56-14.56) 14.56
Jalna	(171.24-216.17) 196.2	(10.7-12.73) 11.77	(425.8-594.3) 487.0	(1726-2993) 2221.3	(453.2-953) 793.7	(0.85-1.36) 1.09	(2.07-2.94) 2.49	(3.93-5.36) 4.77	(10.68-16.45) 13.36

Conclusions

Sweet orange orchard soils of Jalna district are found to be neutral to alkaline in soil reaction, with normal range of salinity along with non-calcareous to moderately nature and poor to rich organic carbon content.

Sweet orange soils were low to optimum in available N, low to medium in available P and rich in available K. Further, it was observed that soils were well supplied with available Ca and Mg contents. Soils were deficient in DTPA Fe and Zn contents and were sufficient in Cu and Mn.

The soil sweet orange orchards of jalna district are available N 96 percent deficient, available P is 64 percent deficient and all orchards soil in 100 percent sufficient in available K. In case the available Ca in 43 percent deficient and Mn in 36 percent deficient in soil. Among micronutrients, soils were deficient in DTPA Fe 44 percent and Zn 51 percent contents and were 100 percent sufficient in DTPA Cu and Mn.

Soil healthy sweet orange orchards of Jalna district are available N 51 percent deficient, available P 38 percent deficient and all orchards soil in 53 percent sufficient in available K. In case the available Ca in 21 percent deficient and Mn in 17 percent deficient in soil. Among micronutrients, soils healthy were deficient in DTPA Fe 27 percent and Zn 26 percent contents and all healthy orchards were 53 percent sufficient in DTPA Cu and Mn in soil healthy sweet orange orchards.

Soil unhealthy sweet orange orchards of Jalna district are available N 45 percent deficient, available P 36 percent deficient and all orchards soil in 47 percent sufficient in available K. In case the available Ca in 22 percent deficient and Mn in 19 percent deficient in soil. Among micronutrients, soils unhealthy were deficient in DTPA Fe 17 percent and Zn 25 percent contents and all unhealthy orchards soil were 47 percent sufficient in DTPA Cu and Mn in soil unhealthy sweet orange orchards.

References

1. Dhale, Jagdish Prasad. Characterization and classification of sweet orange – growing soil of Jalna District, Maharasra. Reported that. J. Indian Soc. Soil Sci. 2009; 57(1):11-17.
2. Gorde AS. Evaluation of nutrient status of selected Citrus orchard of Aurangabad district by soil and plant analysis. *M.Sc. (Agri.) Thesis*, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra, 1994.
3. Jackson ML. Soil Chemical Analysis. Prentice Hall of India. Private Ltd. New Delhi, 1973.
4. Jadhav VH. Assessment of fertility status of soils under sweet orange (*Cirtus sinensis osbeck*) in Nanded district. *M.Sc.Thesis* Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Maharashtra, 2007.
5. Kausadikar HK. Studies on nutritional disorders in sweet orange and their response to multi micronutrient application. *Ph.D (Agri.) Thesis*, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, 2005.
6. Kausadikar HK, More SD. Status of micronutrients in Maharashtra, Soils, their deficiencies and management in fruit crops. *Bull. Res. – Ext - user.* Industries Interface on micronutrients 17 and 18. Jan 2003 at IMT, Pune, 2003.
7. Malewar GU, Varade SB, Jadhav NS. Evaluation of nutritional status of Citrus orchards of Marathwada region by leaf and soil analysis. J. Maharashtra. Agric. Uni. 1978; 3:95-99.
8. Olsen SR. Estimation of available phosphorus in soil by extraction with sodium bicarbonate U.S. Dept. to Agric Washington D-C-C-IRC-939, 1954.
9. Panse PV, Sukhatme. Statistical Methods for Agriculture workers, publ. ICAR, New Delhi, 1985.
10. Patil VD. Assessment of chemical and biochemical indices for diagnosing zinc deficiency and soil associated factors of Citrus (*Citrus sinensis osbeck)* nutrition *Ph.D. (Agri.) Thesis* Vasantrao NaikMarathwada Krishi Vidyapeeth, Parbhani Maharashtra, 1997.
11. Patiram C, Upadhaya RC, Singh MH, Munna Ram. Micronutrient cation status of Mandarin (*Citrus reticulata Blanco*) orchards of Sikkim. J. Indian Soc.Soil. Sci. 2000; 48(2):246-249.
12. Sharma VK, Mahajan KK. Studies on nutrient status of Mandarin orchards in Himachal Pradesh. Indian J. Hort. 1990; 47(2):180-185.
13. Singh MB, Sharma KS. Combating Micronutrient deficiencies in Citrus crop. *Indian Hort.*, 2000; 45(2):8-10.
14. Srivastava AK, Shyam Singh. Soil analysis based diagnostic norms for Indian Citrus cultivar. Commun. Soil Sci. and plant anal. 2004; 33(1-2):1689-1706.
15. Srivastava AK, Shyam Singh. Diagnosis of Citrus Nutrition. IBDCO publication Lucknow. India, 2003, 87-97.

16. Subbaiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. *Current Sci*. 1956; 25(8):256-260.
17. Tandon HLS. Micronutrients in soils, crops and fertilizers – A source book cum directory. 2nd Edition, fertilizer development and consultation organization, New Delhi: 177 + VI, 1999.
18. Thakur R, Sawarkar SD, Vaishaya UK, Singh M. Impact of continuous use of inorganic fertilizer and inorganic manure on soil properties and productivity under vertisol. J. of Indian Soc.of soil Sci. 2011; 59:74-81.
19. Walkley A, Black CA. An examination of the digestion method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Sci*., 1934; 37:29-30.